ZigBEE

ZigBee is an open global standard for wireless technology designed to use low-power digital radio signals for personal area networks. ZigBee operates on the IEEE 802.15.4 specification and is used to create networks that require a low data transfer rate, energy efficiency and secure networking. It is employed in a number of applications such as building automation systems, heating and cooling control and in medical devices.

ZigBee is designed to be simpler and less expensive than other personal are network technologies such as Bluetooth.

One of ZigBee's defining features is the secure communications it is able to provide. dis is accomplished through the use of 128-bit cryptographic keys. dis system is based on symmetric keys, which means that both the recipient and originator of a transaction need to share the same key. These keys are either pre-installed, transported by a "trust centre" designated within the network or established between the trust centre and a device without being transported. Security in a personal area network is most crucial when ZigBee is used in corporate or manufacturing networks.

Device types

ZigBee defines three different device types: Coordinator, Router, and End device.

Coordinator

ZigBee networks always have a single coordinator device. This device starts the network, selecting the channel and PAN ID, Distributes addresses, allowing routers and end devices to join the network. Buffers wireless data packets for sleeping end device children.
The coordinator manages the other functions that define the network, secure it, and keep it healthy. This device cannot sleep and must be powered on at all times.

Router

A router is a full-featured ZigBee node. This device can join existing networks and send, receive, and route information. Routing involves acting as a messenger for communications between other devices that are too far apart to convey information on their own.
Can buffer wireless data packets for sleeping end device children. Can allow other routers and end devices to join the network. Cannot sleep and must be powered on at all times. We can have multiple router devices in a network.

End Device

An end device is essentially a reduced version of a router. This device can join existing networks and send and receive information, but cannot act as messenger between any other devices.
Uses less expensive hardware and can power itself down intermittently, saving energy by temporarily entering a nonresponsive sleep mode. Always needs a router or the coordinator to be its parent device. The parent helps end devices join the network and stores messages for them when they are asleep.
ZigBee networks may have any number of end devices. In fact, a network can be composed of one coordinator, multiple end devices, and zero routers.

Modes of operation

The XBee ZigBee RF Module is in Receive Mode when it is not transmitting data. The device shifts into the other modes of operation under the following conditions:

— Transmit Mode (Serial data in the serial receive buffer is ready to be packetized)

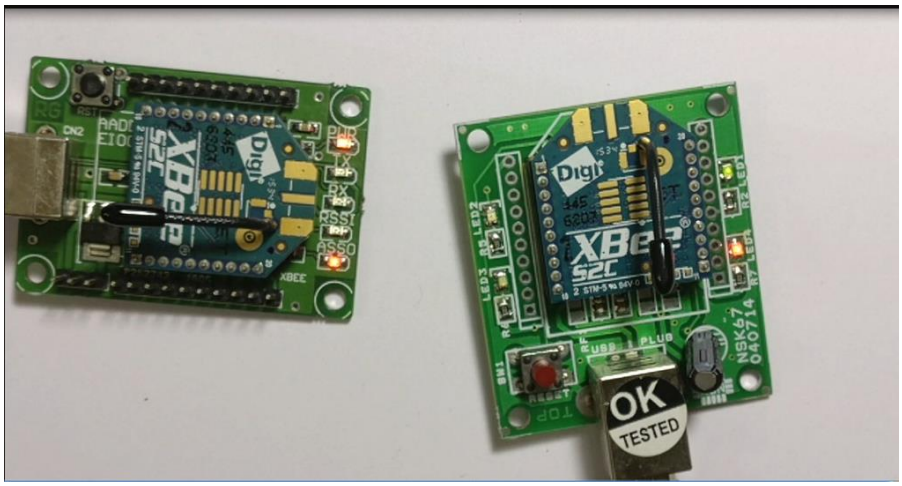
— Sleep Mode

— Command Mode (Command Mode Sequence is issued, not available when using the SPI port)

Now let us practically see how to configure the Radio S2C. For communication one of the Radio is to be configured as COORDINATOR & the other one as Router.

XBee Setup

To configure the XBEE you need an USB XBEE Adapter (as below) which can be easily connected to the USB port of your PC.



In case you do not have dis USB board, you can use you're Arduino board as USB-UART. For dis you need to connect RST of Arduino to GND. This bypasses the bootloader of Arduino & the board can be used for Serial communication. Remember to connect Rx to Rx, Tx to Tx (straight & NOT reverse connection) between Arduino & XBEE while configuring.

Configuration Steps

Let us start with the configuration. Plug the S2C modules on to the USB adapters & connect to USB ports of your PC.

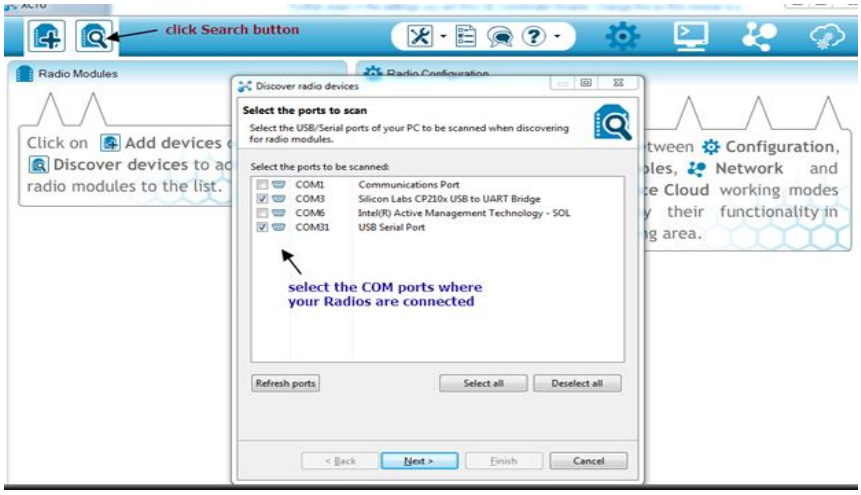
Open the new XCTU Software .S2C can be configured with this new XCT. The classic old XCTU does not support the S2C module.

Click on the SEARCH icon on top to detect the USB ports.

A list of active USB COM ports will be displayed.

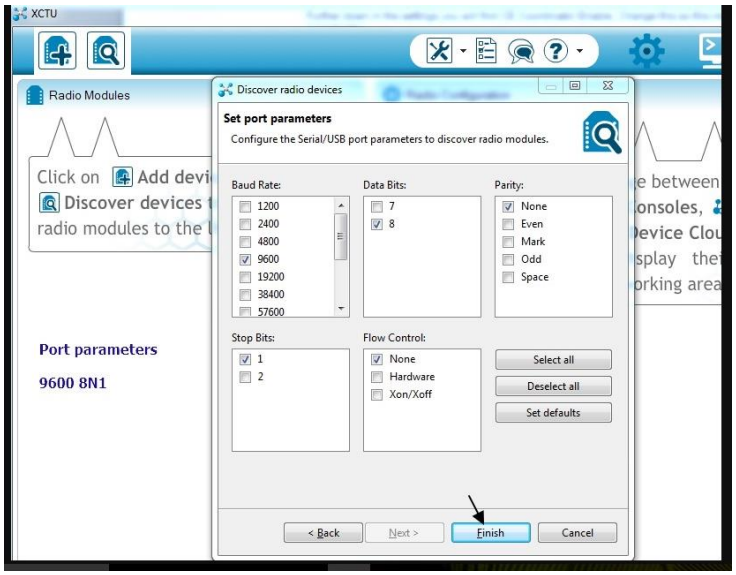
Select the COM ports where you've connected the USB adapters. To confirm you can verify your DEVICE MANAGER for the proper COM ports.

In my case one of the USB adapters is allotted COM3 & the other one COM31.



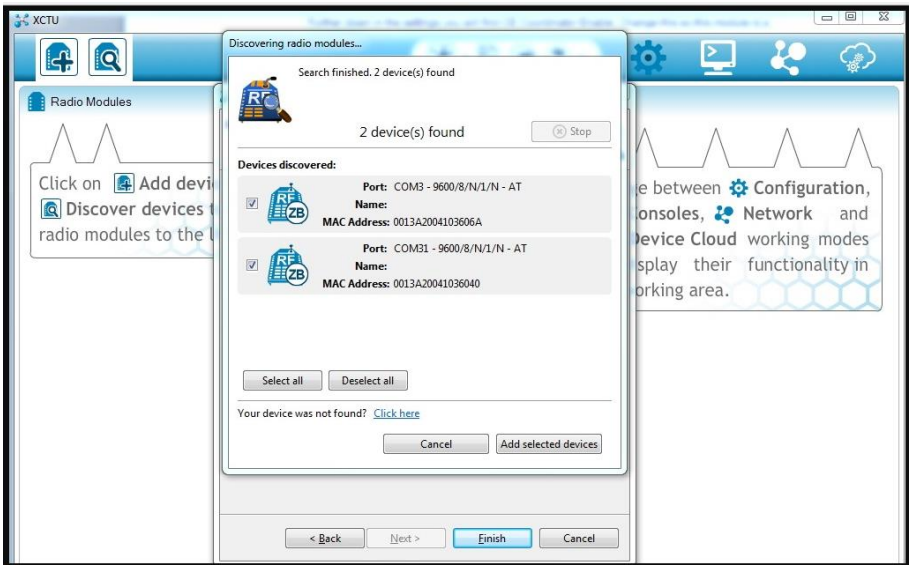
Click on NEXT & accept the default PORT PARAMETERS.

96008N1 is the default. 9600 is the BAUD RATE, 8 Data Bits, No Parity & 1 Stop bit.

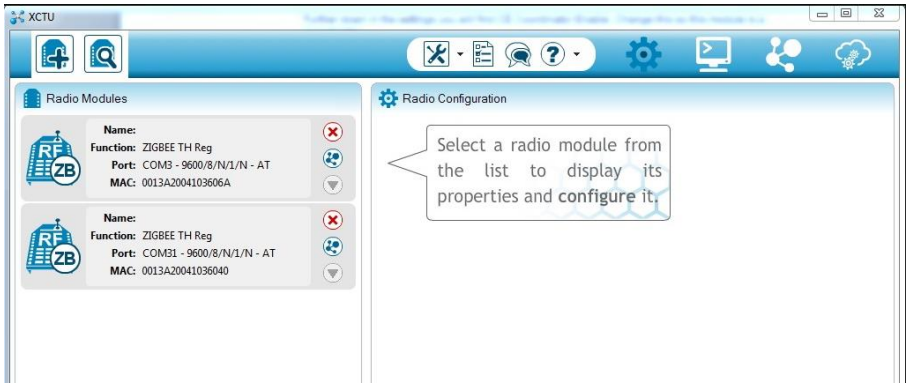


Click on the FINISH button.

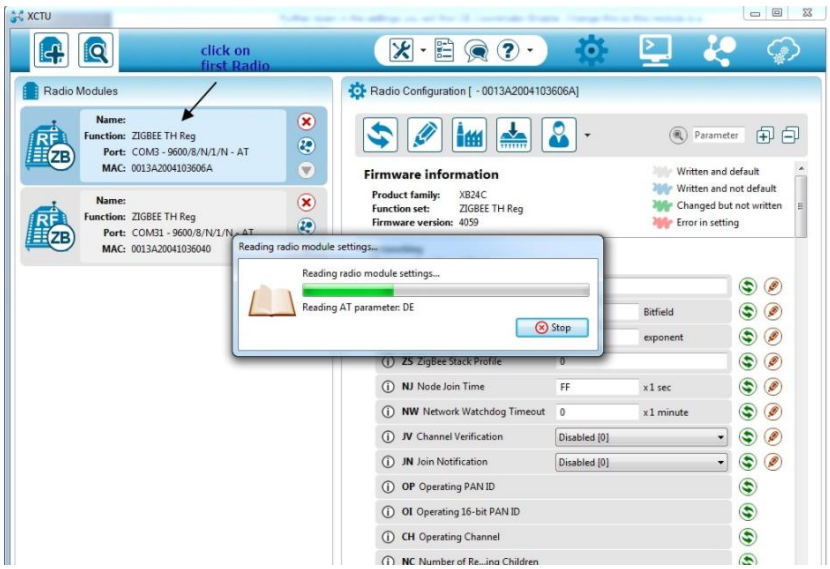
The XCTU scans the USB ports selected & lists the RADIOs found with their unique 64 bit address.



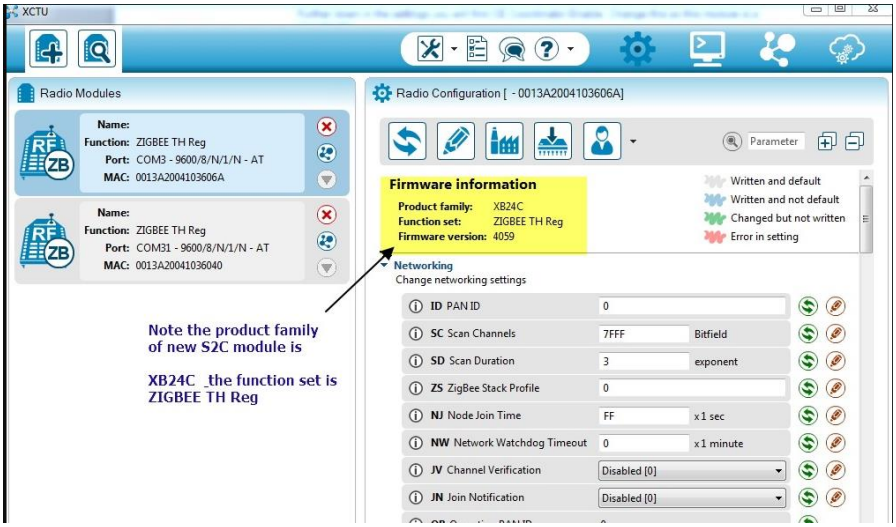
Select both the devices & click ADD SELECTED DEVICES.
Now both the Radios appear on the left pane.



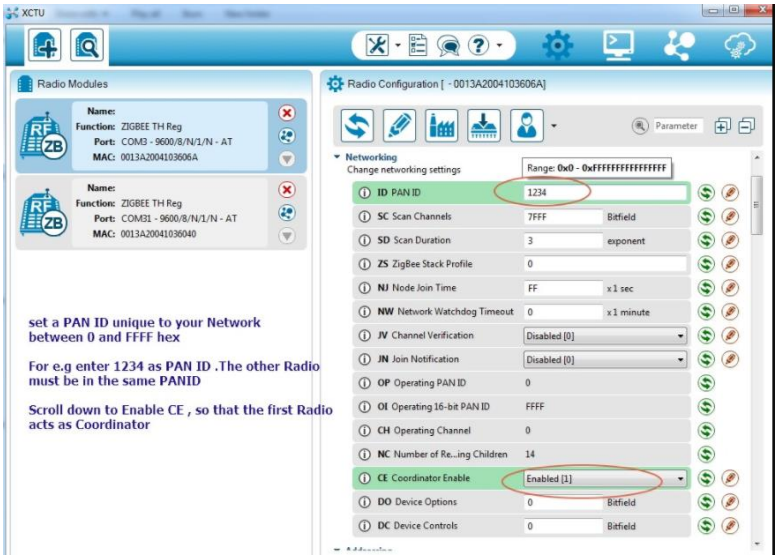
Let us configure the RADIO at COM3 as COORDINATOR first.
Click on the COM3 RADIO to load the module settings.



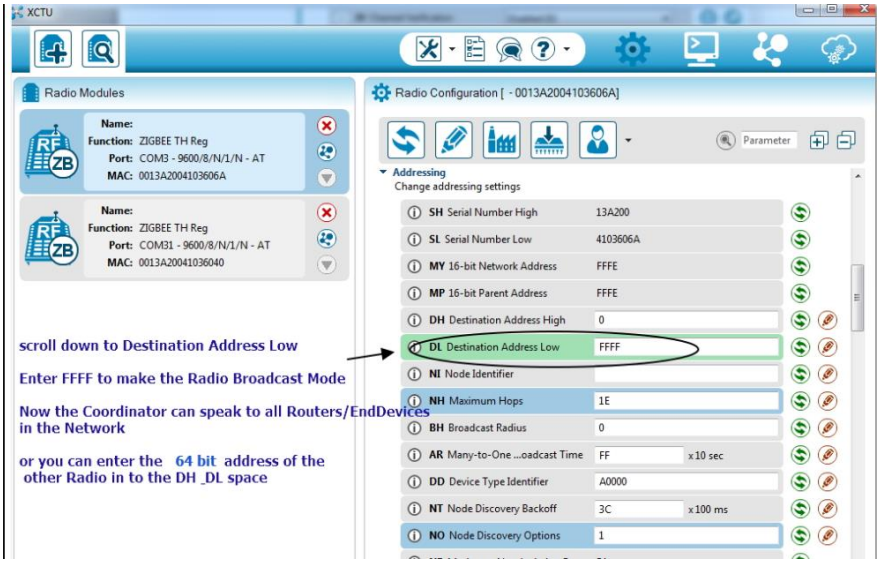
Once the parameter settings are loaded you can see that the product family is XB24C (in case of oldS2 it is XB24-ZB & of S1 is 802.15.4)
The function set of Firmware is ZIGBEE TH Reg, the Reg stands for Regular & not PRO. TH stands for THROUGH HOLE & not SMD.



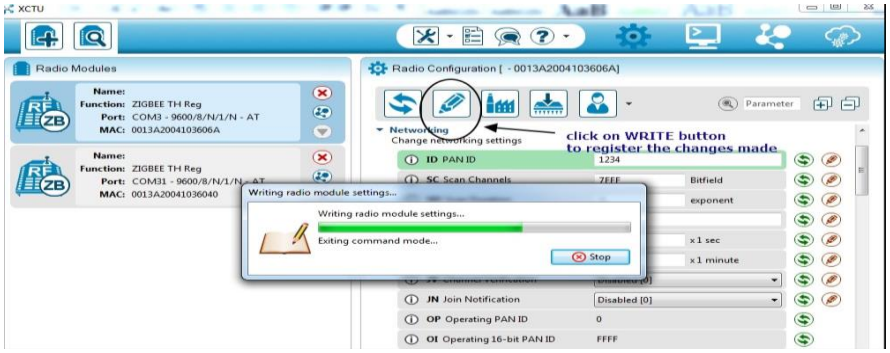
First thing is to set the PAN ID of the Network. This can be from 0 to FFFF hex. In my case I'm setting it to 1234.The other Radios also to be set in the same PAN ID.
Scroll down further & Enable the CE (Coordinator Enable)



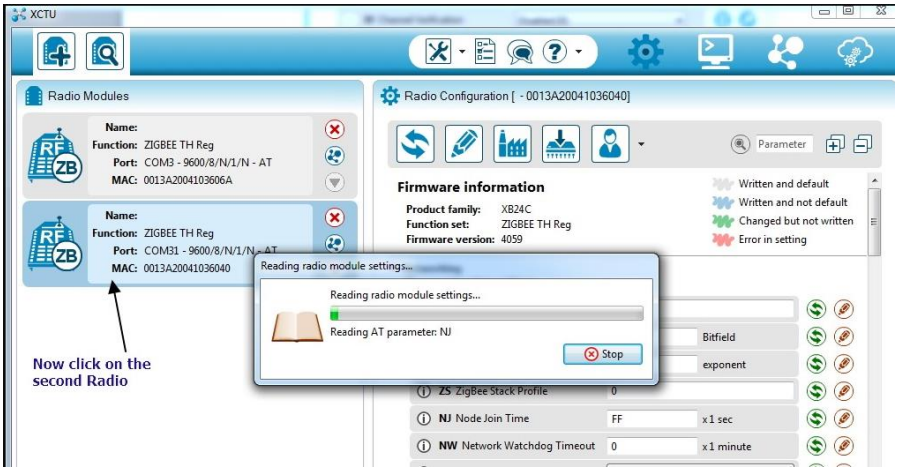
The Destination address DH is left to default 0.
The Destination Address DL is set to hex FFFF which makes the Radio work on BROADCAST mode, so that it can communicate with all Radios in the same PANID.
The Node Identifier can be given any name like "Coordinator". This name is optional.



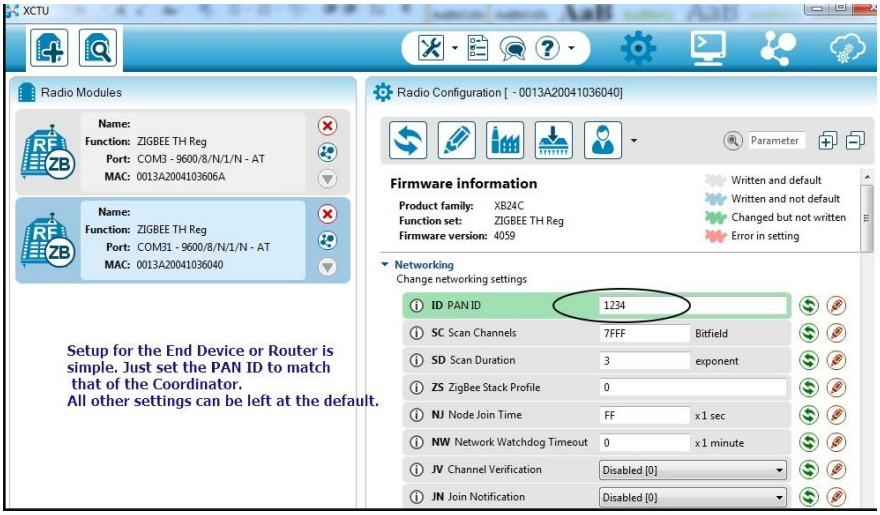
Click on the PENCIL icon on top to WRITE the changes made.



Now let us configure the second Radio as ROUTER.
Click on the second Radio on the left pane to load the settings.



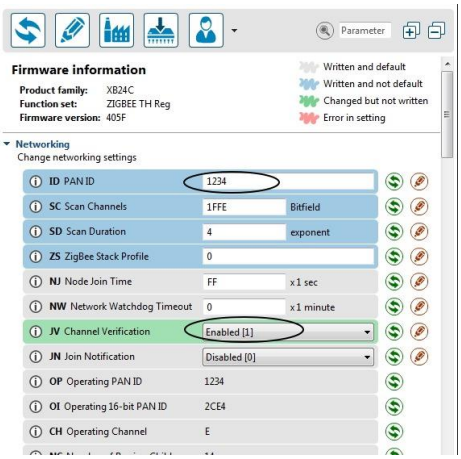
The Router setting is quite simple.
Enter the PANID as 1234, same as that of Coordinator.

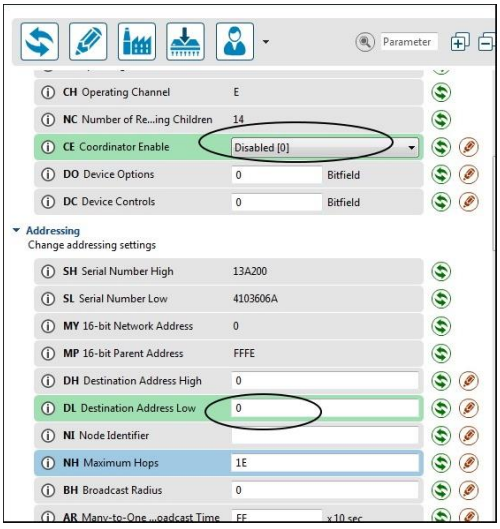


JV CHANNEL VERIFICATION is Enabled.

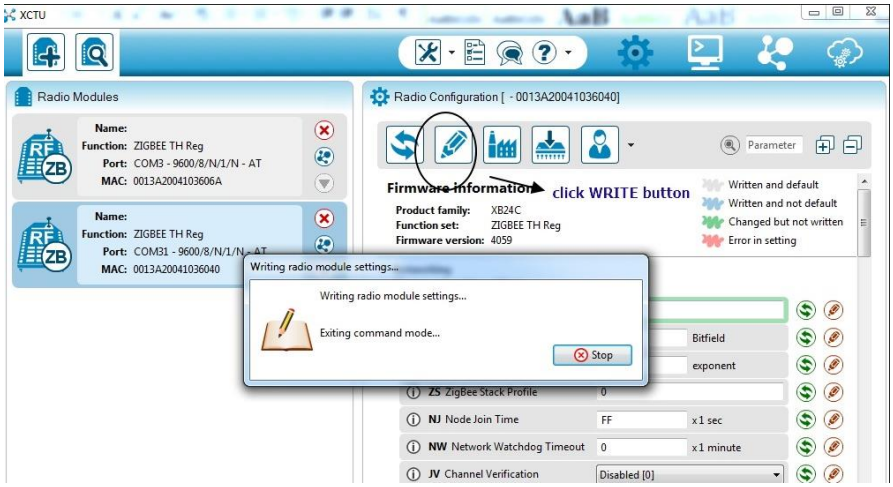
CE Coordinator is DISABLED

Destination Address DL is left to default 0. (0 is the default address of Coordinator)





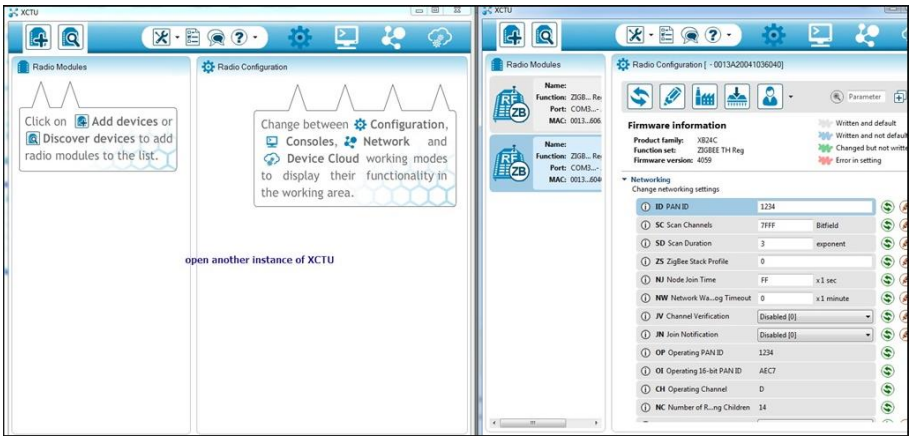
Click on the Write button to save the changes made.



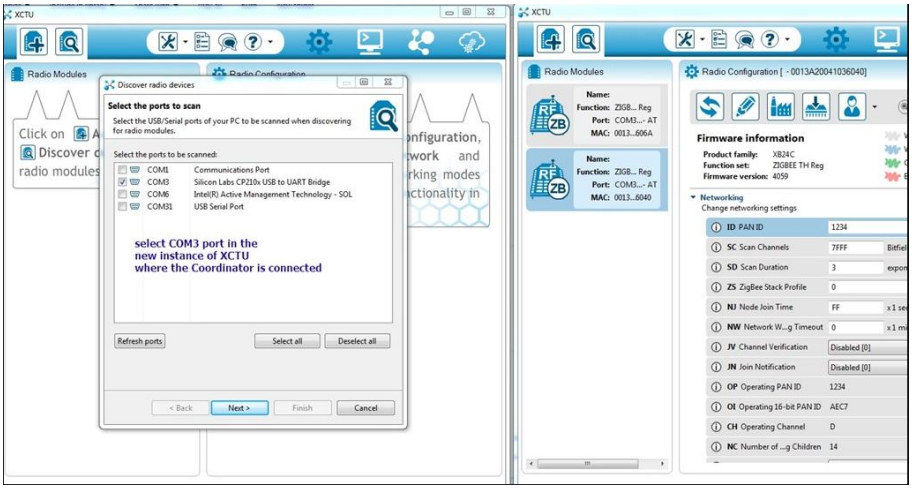
The modules are paired & ready for communication.

Now let us test the communication. On the XCTU window delete the second Radio .Click on the first Radio to load the settings.

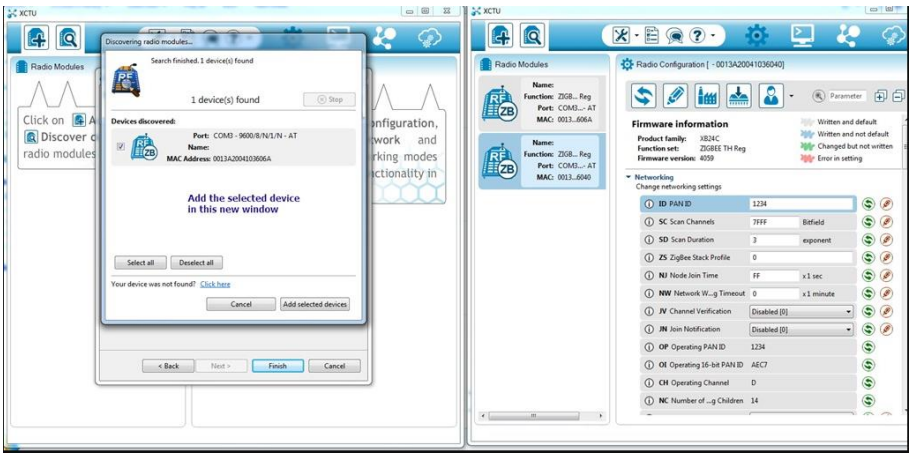
Leaving the XCTU window open, start another instance of XCTU &position it to the left of the previous window.



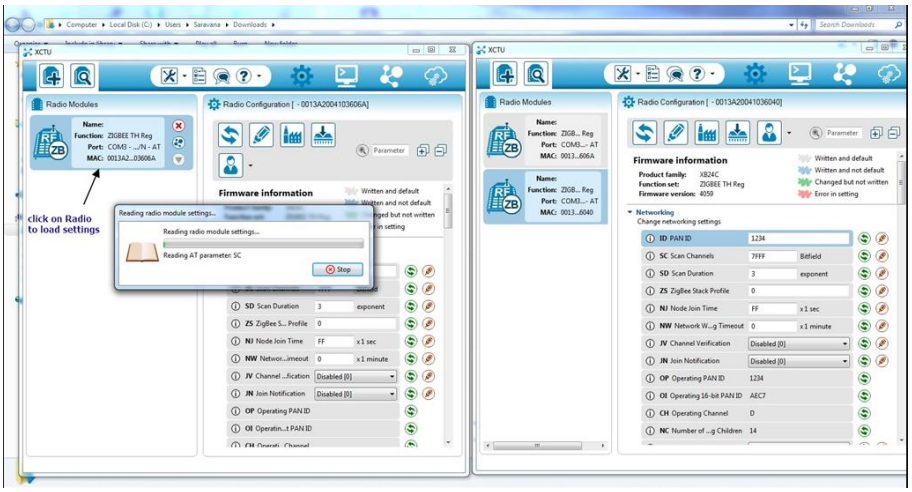
Click on the Search button on the new instance of XCTU & select the second Radio.



Click on the Radio selected to load the settings.

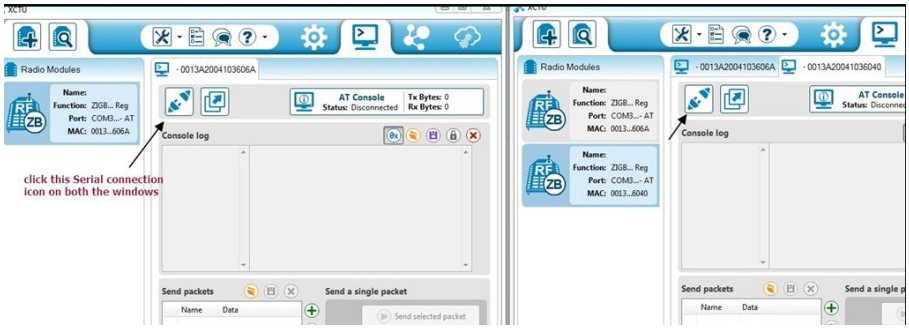


Now the ROUTER Radio is on the left side & the COORDINATOR Radio to the Right.



Click the TERMINAL icon on both the windows to enter Terminal mode.

Click on the SERIAL CONNECTION icon on both the windows to enter the serial connection mode.



You can see the SERIAL Icon in LOCK mode & the AT CONSOLE Status changes to CONNECTED.
Now you can type any message inside console log window & see that received on the other Radio.
The transmit message is in BLUE & received message in RED.